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ABSTRACT

Technology is a word which seems unavoidable now in discussions of literacy theory and practice. The question of what form literacies will take in a century likely to be defined by a new technological environment has become a present issue for nearly everyone involved with literacy today. This paper contends that at the core of both the excitement and unease about technology are deeper issues about literacy and its relation to the physical world, the nature of knowledge, social change, linguistics, aesthetics, and morality. The paper first considers some basic questions that parents, teachers, administrators, researchers, and others might ask about the stance to take regarding technology. It then discusses reading and writing technology, featuring examples which focus on an array of new technologies (on the Internet) in university-level teaching, each of which suggests that the introduction of new technologies results in new literacy practices. The paper also discusses why people cannot stand apart from technology and muses about a transactional view in a sociotechnical account of literacy. It considers some implications for literacy research and practice in the claim that literacy is a sociotechnical practice. Finally, the paper concludes that to ask what stance should be taken toward technology presupposes a view of technology that is fundamentally limited--in fact, technologies do not oppose, replace, enhance, or otherwise stand apart from literacy, but rather, they are part and parcel of it. Contains 61 references. (NKA)

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Literacy Technologies: What Stance Should We Take?

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Technology. The word seems unavoidable now in discussions of literacy theory and practice. Parents ask the teacher or school principal what the school is doing about computer literacy and networking. Librarians are alternately invigorated or distressed thinking about what new information technologies mean for their work. Teachers wonder about whether these technologies will improve children's literacy skills or take them forever away from traditional reading and writing. Theorists debate whether the book is dead. Nearly everyone struggles just to stay minimally aware of new technological developments and their social implications. The question of what form literacies will take in a century likely to be defined by a new technological environment (Bruce, 1995; Burbules & Bruce, 1995; Reinking, 1995; Reinking, McKenna, & Kieffer, in press) has become a present issue for nearly everyone involved with literacy today.

Underlying both the excitement and the unease about technology are deeper issues about literacy and its relation to the physical world, the nature of knowledge, social change, linguistics, aesthetics, and morality. At the core are questions about what it means to be human. If we open up the current debates to these underlying issues, we may find not only that we arrive at different conclusions, but that our understanding of literacy itself has changed.

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Adopting a Stance Toward Technology

The issues regarding technology that concern parents, teachers, administrators, researchers, and others challenge us to ask some basic questions. For a start: What should be the stance of literacy educators and researchers toward technology? Where does technology fit with respect to other concerns about reading and writing processes, learning, multiculturalism, texts, assessment, and sociocultural contexts? Will new technologies fundamentally alter the nature of literacy or are they a passing fad? Several possibilities emerge immediately: Neutrality. Some say no stance toward technology is needed, thus arguing for neutrality. They stress that literacy is about feelings and ideas; technology is about things. Texts and objects are separate realms. This stance accepts technologies as potentially valuable, and technology as a valid area of study, but it does not connect either specific technologies or technology studies to its primary concerns about the life of texts.

Opposition. Others go beyond the neutral position to stand in opposition or resistance to technology. For them, the inevitable uses of technologies for surveillance, regimentation, and social stratification far outweigh the alleged benefits. Slouka (1995) worried about a retreat from reality into the virtual worlds of new technologies. He argued that "the real significance of our retreat from the world may be not so much in the technology that makes it possible as in the revolution in attitude that makes it appealing" (p. 68). Following Ellul (1980), many fear that technicizing society will progressively destroy the last bit of our humanity. Some argue further that, in this materialistic, technologically driven world, a major function of literacy, and especially literature, is to support human values against the technical. Like Dilthey and other early hermeneuticists (Palmer, 1969), who saw the imperative for counterposing human to natural sciences, they feel compelled to hold human conceptions against the technological. Only through the human realm of interpretation and adherence to human values can we then avoid reduction to the level of the machine.

Utilitarian. In contrast, others argue for a utilitarian stance, saying "technology provides marvelous new tools for teaching and learning that can improve literacy education." Surely, they must be employed with care, but one can find many ways to make use of these new tools. Many recent studies (Bruce & Rubin, 1993; Bruce & Sharples, 1995; Garner & Gillingham, 1996; Handa, 1990; Schutte, 1996) on electronic communication in classrooms might then be cited as evidence that the use of new technologies can have beneficial effects on learning and teaching. The utilitarian could be characterized as having a stance toward technology analogous to what Rosenblatt (1978) called the efferent stance toward literature, one that sees a text as a repository of information. Technologies are then repositories of capabilities for teaching and learning.

Skeptical. Representing the pessimistic side of utilitarianism, but closely allied to it philosophically, is one of practical skepticism. Proponents of this stance might say, "I've seen many so-called 'marvels'; show me that technology really makes a difference and I'll begin to listen more." Unlike one who adopts the oppositional stance, the practical skeptic does not see great dangers in technology, just overblown rhetoric about it. The great willingness of technology to break down when it is needed most is the skeptic's first line of argument, but the educational system's inertial resistance to change is their best answer to the optimistic utilitarian (Neilsen, in press; Peyton, 1990). Transformational. Going beyond utilitarianism, and sitting at the far extreme from the oppositional position, are those who argue that new technologies are transformational: They will replace or radically transform the basic definition of literacy (Reinking, McKenna, Labbo, & Kieffer, in press; Soloway, 1993; Spender, 1995). This position sees the end result of this transformation as essentially positive, though the process itself is not without difficulties along the way. The transformationalist argues that our task then is to understand and guide this transformation.

Aesthetic. Following Rosenblatt again, there are numerous examples of an aesthetic stance toward technology. Many artists, for example, see new information technologies as affording rich opportunities for creativity in electronic media. They talk of a paradigm shift as artists move from using the computer to create or reproduce art to accepting electronic representations per se as finished art (ad319, 1994).

The aesthetic response reminds us that if technology does lead to changes that the course is not easy to predict. Do we really know what the fundamental skills for 21st-century literacy will be? It is unlikely that they are simply keyboarding skills or knowing how to use a CD-ROM. Nathan Shedroff (internet.au, 1997), a professional webpage designer, suggests one possibility when he says:

> Few people are ever taught to create successful, satisfying experiences for others. Mostly, those folks are in the performing arts: dancers, comedians, storytellers, singers, actors, etc. I now wish I had more training in theater and performing arts to rely on , especially improvisational theater. That's like the highest form of interactivity. (pp. 40-41).

The aesthetic stance can thus be added to the neutral, oppositional, utilitarian, skeptical, and transformational stances to form an incomplete list of possible positions one might assume with respect to new technologies. The differences among these stances are sharp, signifying much more than nuanced differences in interpretations of empirical data. They speak to different views of literacy and technology, but also to different conceptions of language, of education, and of basic human values.

Moreover, the stance one adopts entails distinctly different choices regarding uses of technologies and overall curricular goals. And beyond a host of immediate practical decisions, that stance shapes what counts as literacy studies and how we conceive of literacy practices. In fact, it defines to a large extent the very purpose of literacy.

The Reflexivity Problem

But oddly, despite the differences between these positions, they all share at least one important assumption. They each construct "technology" and "literacy" as distinct realms, with literacy over here and technology over there. In fact, technology is not just over there, but out there, at most in a distant suburb of literacy, if not on another planet. The point of contact among the stances, and thus their point of difference, is over how the realms of literacy and technology ought to relate, whether we should be building a wall to keep technology out or a highway to bring it in. In either case, the shared starting assumption is that we are discussing two autonomous realms:

This view of technology as autonomous from literacy derives from what Latour (1991) called the "technology/society divide" (p. 103), a divide deeply ensconced in our discourse about technology. It manifests itself clearly in the extreme positions, that one can stand opposed to a technology outside of us, or that we will be transformed by that technology, but also in the belief that one could be neutral about technology, or see it as only a tool.

The divide is so integral to our thinking that it is difficult to see at first how it could be other than a natural division or why it would be problematic to conceive it as such. Of course, one cannot entirely avoid conceptualizing technology per se or social reality per se. But dividing the material from the social is less a grounded conclusion about the nature of sociotechnical reality than a linguistic convenience, one that ultimately causes more confusion than clarity. It is what I have described elsewhere as the "autonomy myth" (Bruce, 1996). Now, myths are natural, and useful starting points for inquiry, but they also constrain how we think. One constraint of the autonomy myth is that it lures us into one or another determinism (see Bromley, 1997; Bruce, 1993). We see technology as pre-given and thus independently shaping social practices. Or, we view societal relations as all encompassing, thereby finding it difficult to account for the specific effects of distinct technologies. In literacy research, we are lured into asking a question like, "What is the effect on writing of using a word processor?" (see Bangert-Drowns, 1993; Bruce & Rubin, 1993), as if the device were determinate of social practice. We then become puzzled by conflicting findings: It helps writers a lot; it makes writing worse; it makes no difference. Our autonomy assuming research paradigms cannot accommodate a social reality comprising technologies, artifacts, texts, signs, and people that dynamically reconfigure each other's meaning.

Thus, it becomes difficult to discuss mutual constitution of technologies and social relations. Everything about technologies, their design, distribution, use, and even the way we interpret their effects, are ideologically embedded (Bruce & Hogan, in press). Moreover, as we analyze, discuss, and use technologies, we change them. This is what Soros (1997) called "reflexivity" in social and political affairs: a feedback mechanism between thinking and events. When we decide to use a word processor as a publishing device rather than as a text editor, we have redefined it. Our use indexes a changed

conceptualization, but also a changed reality, in which prior statements about the word processor may no longer hold. And our thinking changes as we experience events involving the technology.

Moreover, we ourselves change as we adopt new capabilities that the technology affords. As we become more facile with the word processor, it takes on new meaning in our lives; it acquires powers it did not possess before, just as we feel empowered. This reflexivity makes moot any question of social or technological determinism, suggesting instead a more dynamic and multifaceted conception of social practices.

This point becomes more meaningful when we examine examples of literacy in contrasting technological contexts. For example, we might look at the set of literacy practices carried out by university faculty and students, like, I presume, many of the readers of this article. Although there would be enormous differences as we looked from person to person or across time, we would inevitably see an array of communication and information technologies in each case, including, perhaps, books, paper and pen, blackboards, overhead transparencies, filing cabinets, index cards, copy machines, scanners, word processors, or Internet. Just listing the technologies in use would tell us something, but not that much. We would instead need to find out how those technologies were constructed, both in the sense of questions like "How large is the filing cabinet?" or "What features does the word processor offer?" but also in terms of the role those technologies were deemed to play in literacy practices, in other words, the stance people held toward them. We might then begin to see the technologies as part of a larger system of relations, and as we looked closer, we might find that it was less and less easy to mark off the technological from the social. Consequently, we would find it increasingly tenuous to hold on to any conception of the technological as simply "out there."

Reading and Writing Technology: Becoming What We Envision

It is natural to think of technology first in terms of physical artifacts, for instance, a plastic box with wires and silicon chips inside. Such is the core of the autonomy myth, for how could silicon chips be part and parcel of a complex set of social practices such as literacy? To see why the physical artifact conception is flawed or why physical artifacts are more than they seem, it is necessary to look in detail at examples of lived technology/literacy practices. What we see invariably is that the meaning of, in an important sense, the very construction of technology, has only a little to do with specific characteristics of particular physical artifacts. Instead, those artifacts are expressions of social relations. Thus, literacy is expressed through its technologies rather than determined by them.

But we must pause a moment here. It is too easy, and wrong, to say that artifacts are only expressions of social relations, because, as artifacts manifest social relations, they appropriate the power they express. That is why the canon battles are so intense. The Complete Works of Shakespeare is much more than some volumes of poetry and drama; it is the touchstone for a complex set of social indices such as culture, quality, education, Eurocentrism, literature, and class. (It is now a web site, http://thetech.mit.edu/Shakespeare.)

Similarly, the digital computer today signifies as well as computes (Bromley, in press). In areas where there is public-school choice, many parents select a school based on its computers and network connections. It is a fair bet that many of these same parents have not studied exactly how the computers and networks will improve their child's learning, but they cannot ignore the iconic appeal. And, without necessarily articulating this, they may be wisely seeing the computer as an indication of the school's willingness to innovate, its overall financial strength, parental involvement, or many other characteristics beyond digital processing. As a consequence, artifacts become actors (Latour, 1993) that can shape the direction of social practices.

This means that what we might call the face of information technology grows out of life experience, gender, race and class relations, social status, ideologies, pedagogical values and beliefs about knowledge, language, and learning. In fact, technologies are so deeply embedded in social practices that it is sometimes difficult to see what else they might have become. But the process stands out when we consider contrasting contexts for literacy and technology.

In the following examples, I focus on the use of an array of new technologies in university-level teaching. In each case, we see that the introduction of new technologies results in new literacy practices. The meaning of literacy does change when people use these new representations and new tools to read and write. That is why literacy cannot be separated from its material realizations. On the other hand, the technologies underdetermine those literacy practices, because their meaning is constituted by that system of practices. What emerges are different readings of information technology that both reflect and shape literacy practices in these settings. Each university sees a different face on the "same technology."

The universities in question are not identified, although the depictions are faithful to real, specific colleges within those universities. Each university is ranked highly among universities of the world and, compared to other universities in its country, can be considered advanced in its understanding of and use of digital information and communication technologies. Among other technical resources, each university has a

strong computer-science department and has pioneered in areas of hardware or software development. Each has available to it personal computers, local-area networks within the campus, Internet connections, various applications for word processing, Eudora software for sending and receiving email, Telnet software forconnecting to remote computers, web servers, and Netscape software for browsing the World Wide Web and for creating web pages. The key point is not to judge the cases in terms of technology worthiness, but rather to see how different histories, ideologies, pedagogical philosophies, and financial resources result in qualitatively distinct realizations of essentially the same physical devices. Thus, the forms of literacy and the uses of technology within these settings are mutually constituted.

The Face of the Internet at Utilitarian U.

When we think about the Internet in higher education, a question naturally arises: How many college courses now use the Internet? There is now some pretty good data on this. Green's (1996) survey showed that the percentage of college classes using email has risen from 8% to 20.1% to 25.0% over the last 3 years; the use of presentation handouts has increased from 15.1% to 25.7% to 28.4%; and the use of web-based resources has gone from 6% to 9% over the last 2 years. Other data from individual colleges corroborate these numbers. Utilitarian U. (UU) is clearly on the early part of the path implied by Green's findings. A few courses now use email in some way, and at least one course has made extensive use of the web. New digital technologies mean that literacy is not the same as in the generation of the parents of today's students, or even their older siblings. But the changes are not pervasive throughout the university.

If the new technologies were to disappear suddenly, the overall pattern of teaching and learning would not appreciably alter, even though research and graduate studies might suffer significantly. Utilitarian U.'s stance results in a reading of technology that makes it primarily a utilitarian tool. And in a remarkably accommodating way, the technologies play out that role, neither threatening basic social values of the institution nor transforming literacy practices.

The Face of the Internet at Transformational U.

Green's numbers do not quite capture what is happening at Transformational U (TU), which operates within an Internet culture. Local schools have high-speed isdn connections, and many individuals have the same in their homes. The campus has fiber optics connecting offices within buildings to the campus network backbone. On an average day, the campus web server transmits more than 100,000 files of data. (Files may include text, graphics, video, audio, or other data. About half are graphic images linked by web pages.)

In a sense, every course at TU now uses the web: The course is listed in the web timetable; university and department web catalogs describe it; the professor's address and phone are available through the web phonebook. Students use the web to obtain additional information for coursework, just as they use the library; they check out library books related to the course through the web; and they freely use email to contact other students or the professor regarding the course.

Soon, all course syllabi at TU will be on the web. Professors create course materials using web resources; they work at a distance with graduate students for whom the web is an entirely unremarkable aspect of daily work. The ordinariness of the web means that its effects are experienced, but not always noted. Literacy activities do not just make use of the web; as they are realized within the web environment, they are transformed.

A consequence of this transformation is a blurring of course boundaries; completed courses have a continuing life, and future courses in effect use the web before they commence. Students taking one course encounter and interact with course materials for other courses as they conduct research using the web. They might, for example, come across text resources for a course they plan to take because those resources are linked in the relatively seamless web of Internet data. Also, the ongoing dialogue through email, conferencing, and web sites spills over from one course to another, without much regard for course, departmental, and even temporal boundaries. New learning practices develop that affect all courses, not just those that deliberately use the web for shared data, publication, or interactive software. The emerging literacy at TU suggests that operating within the web environment is more salient than specific uses of technology.

One reason is that TU is beginning to experience cascading effects of technological change (Malone & Rockart, 1991). First-order effects are that existing practices are effected in new ways. For example, professors direct students to a web page with course resources rather than to the library reserve collection. This change in means leads to people thinking in new ways, to second-order effects. For example, many students now ask if they can submit assignments through email or on web pages even if that is not requested by the professor, because they know the Internet is part of the college's literacy practices. Professors, in turn, know that all students have email accounts, so they regularly build the use of email into course activities.

These second-order effects may in turn lead to major changes - new relationships between professors and students, new ways of organizing courses and instruction, altered definitions of course work, new kinds of discourse around learning, and new kinds of assessment. These third-order effects are not easily predictable from characteristics of the new tools, and they affect everyone, not just the computer savvy. The net result is that TU is beginning to experience a significant transformation in its daily literacy practices not yet seen at UU.

The Face of the Internet at Oppositional U.

The face of the Internet at Oppositional U. (OU) is necessarily quite different from that at UU or TU . This has little to do with specific technologies - the availability of this or that machine or software - and everything to do with a lived experience of contrasting cultures. Oppositional U. happens to be in China, an aspect of its story that cannot be left out for the sake of a detached research presentation. China is a country with a developing technological infrastructure (Triolo & Lovelock, 1996), but more importantly, an approach to education and a political reality markedly different from that of UU or TU (Cleverley, 1991; Epstein, 1991; Jenner, 1992; Yutang, 1936).

Recently, I spent 3 months living and working in Beijing. Using email and the web were important parts of my literacy practices, especially during this period when I was far from home. But I encountered some difficulties in using these communications technologies, despite the fact that many people I met genuinely tried hard to help me.

Many technological actions that could be assumed at TU were difficult to accomplish within the culture of OU. Sometimes, this was because of resource limitations - fewer computers, slower networks - but often the problem was that no one had yet conceived that such an action was an integral part of doing daily business. Many people did not have email accounts, and for most of those who did, email was not a standard way of communicating. A consequence of this was that the few who were already immersed in email literacy could not use it for most of their interactions. Little of TU 's sociotechnical environment exists at OU. So, if I were to use the web in a course there, I would necessarily engage in a totally different set of activities from what I would do at TU or even at UU. The most serious problem I faced was that my Internet service provider could not make connections to some Internet hosts, in particular, to my university computer in Urbana. Whenever I tried to link, I encountered the error message, "Your machine is not allowed to connect to this host due to your host not being properly registered in the DNS." Error messages are, of course, the spice of human/machine conversations. Anyone who touches a computer soon encounters one or another such arcane messages. The messages rarely help much, because they are written cryptically and presuppose knowledge that the person who made the error is unlikely to possess.

Here is where second-order processes come in. If you are fortunate, there may be someone else around who has successfully negotiated that particular message. But in China today, the Internet is still a novelty, and few people have extensive experience with it. A consequence for me was that I could not find people who knew how to fix the problem, and because I couldn't connect, I couldn't send email to repair the problem. Fortunately, a Chinese friend agreed to help by initiating an email conversation with my university. He wrote a detailed message to my university's computer consulting office asking whether this might be a security issue for either China or the United States and asking what could be done to fix the problem.

The reply to his thoughtful message was in its entirety: "Telnet to staff@uiuc.edu to read and delete mail." On some parts of the planet, this might have been a useful recommendation, but it had nothing to do with the problem at hand. It also failed entirely to address my friend's set of detailed questions. My suspicion is that the writer, who lives in an Internet culture, simply could not conceive of what the real problem might be.

After many messages and extensive consultations, it emerged that the problem was both technical and political. The service provider's machine was not, in fact, properly registered. It took many more discussions to unearth that the reason was "the big guys up there" were limiting Internet registrations as one means to control Internet access. Thus, my ability to access was constrained by working within a developing Internet culture, by the inability of someone outside that culture to understand it, and apparently, by deliberate governmental policy.

I had several meetings regarding the growth of the Internet in China, and its use in education. One Chinese colleague told me that he thought the government wanted to create an "Internet with a Chinese face" just as they are creating "socialism with a Chinese face." The Internet face would come with tight controls regarding access to web sites, creation of Internet domains, use of electronic bulletin board systems, and no email privacy. These controls manifest China's opposition to aspects of new communications technologies, both what Westerners usually describe as their democratizing aspects and what many Chinese characterize as their capacity for fostering immorality, including pornography, excess commercialism, and counterrevolutionary thought.

But my colleague said "mei you ban fa!" (no way!); for every restriction the government imposed, there would be ten ways around it. Nevertheless, it is obvious that the China Internet will have a Chinese face. That sense crystallized for me as I talked with people about Internet use in the United States and reflected on the financial, political, institutional, and sociocultural differences in our schooling systems.

It was also evident in the incidents last year involving student electronic bulletin board discussions. During September, students engaged in a lively interchange about the Diaoyu Islands (islands currently controlled by Japan but claimed by China).

Although the government saw that the general tenor of the discussion mirrored its own position, it was concerned about the use of the Internet for political organizing and about the vigor of the discussion. One student from another university claimed in an email message that he had a flying bomb that would blow up the Japanese embassy. As a result, the government shut down the system. The discussion then moved to a bulletin board at a nearby university. Students from OU continued to join in through a Telnet connection, so the Telnet link was cut. Students then found a way to continue through an alternative technology. Finally, the system at the second university was closed down as well. Two months later, the system was reopened with student monitors carefully controlling the messages. I asked a student about this via email: "When did the [bulletin board] reopen? Has it changed its tone any from before?" She replied: Maybe three weeks ago. Since the discussion of politics is not allowed, many students talk about "LOVE" and "The

Psychology of Sex." In other words, every student is finding some topics which can offend the government. We want them to be annoyed. These two topics seem to have the right function.

What we see here is a complex of literacy practices. The university provides new tools for reading and writing that support sanctioned research and writing activities. When unsanctioned political discussion ensues, the administration moves quickly to reshape the technology, closing off certain features while continuing to support others. Students subvert these actions, thereby reconfiguring their literacy tools. The administration or government reacts, and the students respond again. At each stage, the various participants learn new things about the potential of the technology and actively reconstruct what it, they, and others can do. Their reading of the sociotechnical environment is dynamically reshaped by the actions they and others carry out, while those actions in turn derive from their collective readings.

Will China be able to build a Great Firewall or will the freewheeling style and inherent design of the Internet prevail? It is of course difficult to predict, but what seems clear at this point is that the stance at OU currently results in a reading of technology that contrasts sharply with the reading at TU or UU. Despite many similarities in the "technology per se," the literacy practices are thus markedly different at the three universities, a fact that becomes much less mysterious when the environments are conceived as sociotechnical rather than social or technical alone.

Why We Cannot Stand Apart From Technology

Almost any definition of literacy would have to encompass the kinds of reading, writing, and learning activities students engage in when they take courses at the three example universities. And nearly every aspect of those activities are dramatically affected by the technological aspects of their environment. What students read, and how they read; what they write, to whom, and why; even the content of what they study are different in each sociotechnical context. Thus, reading and writing are embodied practices inextricably linked to their technological matrix, just as they are to formations of gender and race, and to physical settings, discourses, and ideologies (Luke, 1994). This is why the neutral stance defined earlier cannot be plausibly maintained. Technologies participate intimately in the construction of all literacy practices. They are not separate from texts and meaning making, but rather are part of how we enact texts and make meaning. We make texts material through technologies of papyrus, paper, chalkboard, or electronic screen. We also continually redefine what counts as text through these technologies: Novelists write hypertexts, advertisers write in multimedia, and encyclopedias move from paper to digital media. The continual reshaping of literacy occurs directly, but also indirectly, by the lack of what might have been. In other words, even the absence of a technology can become salient. (One could ask: Would a room without a chalkboard still be a classroom?) Today, we see absences that did not exist before. With the advent of the web, it becomes meaningful to speak of whether a course makes use of the web and to note its absence or presence in a way we never could before.

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A similar difficulty occurs with the oppositional stance. One can always, as many do, point out the evils of technology and decry the direction of our increasingly technicized world. But that opposition develops within, rather than standing apart from, a reality defined in part by its evolving technologies. Thus, critiques of the Internet culture can now be found most easily on the Internet itself. They are indexed by Internet search engines, linked to web pages, and read through Internet connections. They thus add to the richness of the Internet, much as modern antifiction and metafiction enrich the world's corpus of fiction literature. McLuhan's epigram that "the medium is the message," and later, "Ö the massage" (McLuhan & Fiore, 1967) cannot be escaped. Even the specific content of opposition must follow technology's twists and turns. As each new media - home video, telephone, fax, virtual reality, Internet chat - has its moment, oppositional critics find their point of reference shifting. Standing in opposition, they necessarily become among the most alert and committed followers of new technological trends.

The utilitarian and the practical skeptic seem to recognize that technology is pertinent to literacy, even though they differ in the degree of that recognition. They each see technologies as possible tools for literacy, but in so doing, they fail to recognize that technologies are already within all literacy practices. If we frame the question as, "Would using technology (e.g., the computer) help students learn to read?" we disguise the fact that both the reading of books and the reading on computers are complex amalgams of technology with other sociocultural practices. Reading itself changes, even as we formulate the question, because we enact it through the very technologies we speak about. So, before we can say whether reading on the computer helps or hurts the reading of books, we see that reading has become something different.

The book, for example, is the emblem of antitechnology for many. But ironically, the mass-produced book is a prime instance of a modern technology artifact, typically written using a word processor, transmitted electronically, edited and typeset using new digital technologies, printed on computer-controlled presses, and distributed through a technology-dependent network of inventory control, accounting, marketing, and sales systems. In a school, it may be entered into a computer card catalog and students write about it using their own word-processing programs. Meanwhile, the computer is not a de novo, high-technology device, but an extension of a long history of literacy practices through other technologies. Screen layout and typography, even terms such as "font" or "web page" derive directly from and expand the typographic culture that digital multimedia are supposed to replace. The web contains books, reviews of books, book stores, publishing houses, and in many ways, promises to become a major maintainer and promoter of book culture.

Today, online sales are becoming a major new distribution channel for books and are one of the most successful areas of retail sales on the Internet. At the same time, the production of books and magazines about the Internet is one of the hottest areas in traditional publishing. Most newspapers now have regular features, if not entire sections, devoted to Internet news. None of this means to say that traditional print and computers

are the same, but rather, that we cannot begin to understand the role of technology in literacy if we set it apart as "only a tool." The picture is more one of multiple literacies, each employing a wide range of technologies that overlap with those of other literacies. Continuing this line of argument, we can see that even the transformational stance can be fundamentally limited. It is true that a careful analysis of literacy practices cannot avoid reference to the technologies employed, and in that sense, different media and literacy tools always imply some degree of transformation of literacy in a given setting. But the argument that new technologies will transform literacy can slip easily into technological determinism, a one-way causality in which using this or that device means we will act in such-and-such a way. The problem with this view can be seen in the debate over how word processing will improve writing. Researchers have found conflicting results, not so much from the use of different research techniques, but because the effects in each case are due to more than the technology alone (Bangert-Drowns, 1993; Bruce & Rubin, 1993). The extent and manner in which the word processor transforms writing is thus a function of the entire sociotechnical environment.

A Transactional View

The assumption that technology and literacy are separate, autonomous realms serves to distance us from the concrete reality of literacy, both as it is practiced today and as it changes in new sociotechnical contexts. The assumption has been challenged from many quarters, though not always in mainstream literacy discourse. Haas (1995), for one, has argued for re-attending to the materiality of literacy, how it is practiced in terms of specific bodily, temporal, spatial, and technological relations. Similarly, Bromley (1997) addressed it in his discussion of the "social chicken or the technological egg." Researchers in the new field of social informatics essentially take the negation of that myth as their starting point.

What alternative is there to the autonomy myth? How might we think about technology in relation to literacy practices in a way that does justice to the dynamic and situated sociotechnical processes of literacy?

Soros's word "reflexive," discussed above, suggests one clue, reminding us as it does of Dewey's early work (1884) on the stimulus arc in psychology. For Dewey, the reflexive nature of perception was crucial to his theories of knowing and learning.

Rejecting both naïve realism, which posits events "out there" independent of the perceiver, and subjectivism, which has no way of accounting for common knowledge, Dewey was led to a constructivist theory of meaning. In his view, knowing was a process in which the individual learned through reflection on ordinary experience and through communication with others.

Within this theory, the actual process of interpreting experiences is transactional (Dewey & Bentley, 1949; Rosenblatt, 1978). This means, in short, that each encounter with phenomena is a unique event, neither wholly determined by external processes nor independent of them. In the case of literacy technologies, a transactional account tells us that technologies do not transform or determine literacies, nor could they ever be irrelevant to literacy practices. Instead, they are part of the continual reconstruction of literacies. As such, they too are constructed out of the evolving literacy practices. A transactional account is not an alternative stance, but rather, a conception of a mutually constitutive relation between technologies and social practices.

There are at least two major ways in which a transactional account figures in sociotechnical analysis of literacy. One is that our reading of technology is itself transactional; we bring to that reading all our unique sociocultural history, just as we do to a reading of Toni Morrison, Judy Blume, or Maurice Sendak. This holds not only for the disinterested researcher, but also for the participants within any literacy situation who use that technology. The second is that a technology within a literacy setting participates in a transaction with the other technologies, texts, artifacts, physical spaces, and procedures present there. For Dewey, these transactions are more richly textured and more organic than might be inferred from terms like "interaction" or "reflexivity." All the actors in a literacy environment - observers, participants, texts, technologies, discourses, and so on - become integral parts of the sociotechnical practice defining literacy in that environment. Thus, the transactional view leads not to another stance toward autonomous technology, but to a conception of literacy as sociotechnical practice.

That view of literacy is consistent with a large body of work on the social construction of technological systems (Bijker, Hughes, & Pinch, 1987; Bijker & Law, 1992), sociotechnical processes (Bromley, 1997; Latour, 1991, 1993; Law, 1991; Winner, 1986); the use of information systems (Kling, 1980; Star, 1989; Taylor, Kramarae, & Ebben, 1993), the technologies of writing (Haas, 1995; Senner, 1989), and processes of situated learning (Lave & Wenger, 1991). These studies of technologies in use show clearly that any technology is deeply intertwined with social relations, in terms of its construction, distribution, use, and interpretation (Bruce & Hogan, in press). As a transactional analysis implies, technologies and social relations are not merely intertwined. The construction of power and agency in social situations derives from a subtle interplay of material and social processes. This interplay leads us to question many taken-for-granted boundaries. Thus, Winner (1986) can ask whether artifacts have politics, and Latour (1991) whether technology is society made durable. Questions such as these have major implications for literacy research and practice.

Implications for Literacy Research and Practice

An immediate consequence is that the technologies of literacy are not optional add-ons, but are part of the definition of every form of literacy. Thus, a theory of literacy in a particular setting or community needs to incorporate an analysis of the relevant technologies, much as we more often include analyses of textual content, pedagogical procedures, personal backgrounds, or institutional agendas. That we often do not incorporate such an analysis may be due in part to implicitly assuming that those technologies are known and fixed. But when we look at literacy cross-culturally, or historically, that assumption becomes untenable.

The earliest human societies undoubtedly had simple forms of communication, at least as advanced as that seen among groups of primates today. In fact, as Dewey (1916/1966) argued, it is no accident that community and communication share the same Latin root; communication is what makes communitender formations are inseparable from studies of literacy. And as Luke (1996) wrote, "literacy training is not a matter of who has the 'right' or 'truthful' theory of mind, language, morality, or pedagogy. It is a matter of how various theories and practices shape what people do with the technology of writing" (p. 309) That we often conceive of writing without mentioning its technologies is less a statement about their centrality to literacy practices and more a statement about how deeply these technologies are embedded in our daily practices.

There is a corollary to the claim that literacy is a sociotechnical practice, which relates to fundamental epistemological and ontological issues, namely, we write ourselves with technologies. We use them to redefine who we are. As we redefine ourselves, we become capable of knowing and doing new things. This has major implications for social goals such as empowerment and equity in education.

It is crucial to note first that technology per se does not empower, but technical practices can construct what counts as ability or need. For example, English fluency is a big advantage in using the web. Thus, lack of English fluency is constructed by the web culture as a disability. One could make a similar point about graphics-oriented pages that cannot be read by those with visual impairments. Thus, the design of a web page constructs a particular level of visual acuity as a disability. The literacy practices one can engage in are to a large extent a function of the available technologies and not a property of the individual. The power of digital technologies to make possible new forms of literate practices thus leads us naturally to a transformative stance on technology.

Instead of just asking, will there be equity or inequity as a result of new technologies, we might start instead with, "What sort of society do we want?" With this frame, we see that if rich schools get all the new computers, it is not that things just happened to work out that way, but rather that we as a society chose to selectively empower one group at the

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expense of another through technology. New technologies make it easier to carry out society's agenda; the key issue is what that agenda should be. Another corollary of literacy as sociotechnical practice turns us to critical and interpretive theory. As literacy researchers, we are accustomed to analyzing texts. We know that texts do not determine meaning, but that specific characteristics of texts,

such as dialect, author's point of view, cultural presupposition, or textual cohesion, can have major consequences for readers. We turn to various theories of reader response (Beach, 1993) to resolve the apparent contradiction between textual indeterminacy and textual agency.

But often, we fail to apply the same critical faculties to new technologies. We may take as given the presence and meaning of technologies in a classroom without asking what meanings students and teachers construct for them. Or, we treat "the computer" as a monolithic device in a way we would never deem adequate for "the book." But a growing body of research is showing that particular constructions of technologies signify in radically different ways and invite very different integrations into daily practices (Bruce & Rubin, 1993).

Information technologies have also been shown to inscribe in various ways relations of gender, class, race, language, nationality, and ability (Selfe & Selfe, 1994), accentuating the "well-trodden battle lines of social conflict" (Foucault, 1972, p. 227). These inscriptions call for a critical theory of technologies, one which at a minimum would begin a process of analyzing the politics of these inscriptions. Such an analysis would provide a foundation for studies of technology use that go beyond asking either-or questions about effectiveness.

Conclusion

To ask, as I do in title of this article, what stance we should take toward technology, presupposes a view of technology that is fundamentally limited. In essence the flaw is an assumption of autonomy - conceiving of technology and literacy as neatly separable realms, such that one could say, "I'm studying literacy now and plan to start on a technology in literacy study next year." The cases above shed doubt on that separation and point us toward a view of literacy as sociotechnical practice and remind us that research in literacy is the study of social practices associated with a particular array of technologies. Thus, technologies do not oppose, replace, enhance, or otherwise stand apart from literacy, but rather, they are part and parcel of it. Technology is within us, imbued with our beliefs and values, and we are within it.

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